

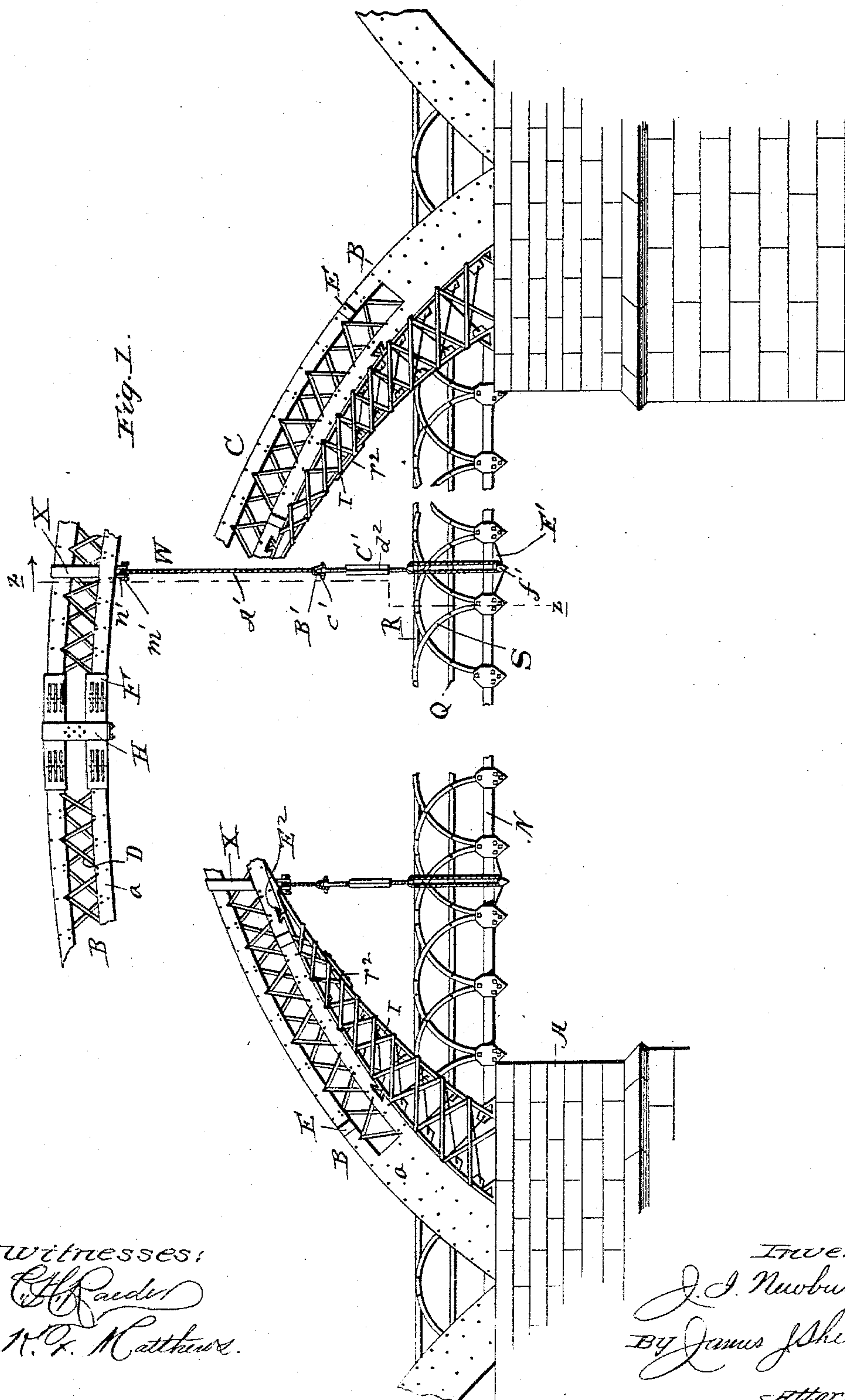
(No Model.)

5 Sheets—Sheet 1.

J. I. NEWBURG.
BRIDGE.

No. 565,020.

Patented Aug. 4, 1896.



Witnesses:
C. H. Raeder
N. P. Matthews.

Inventor
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Attorney

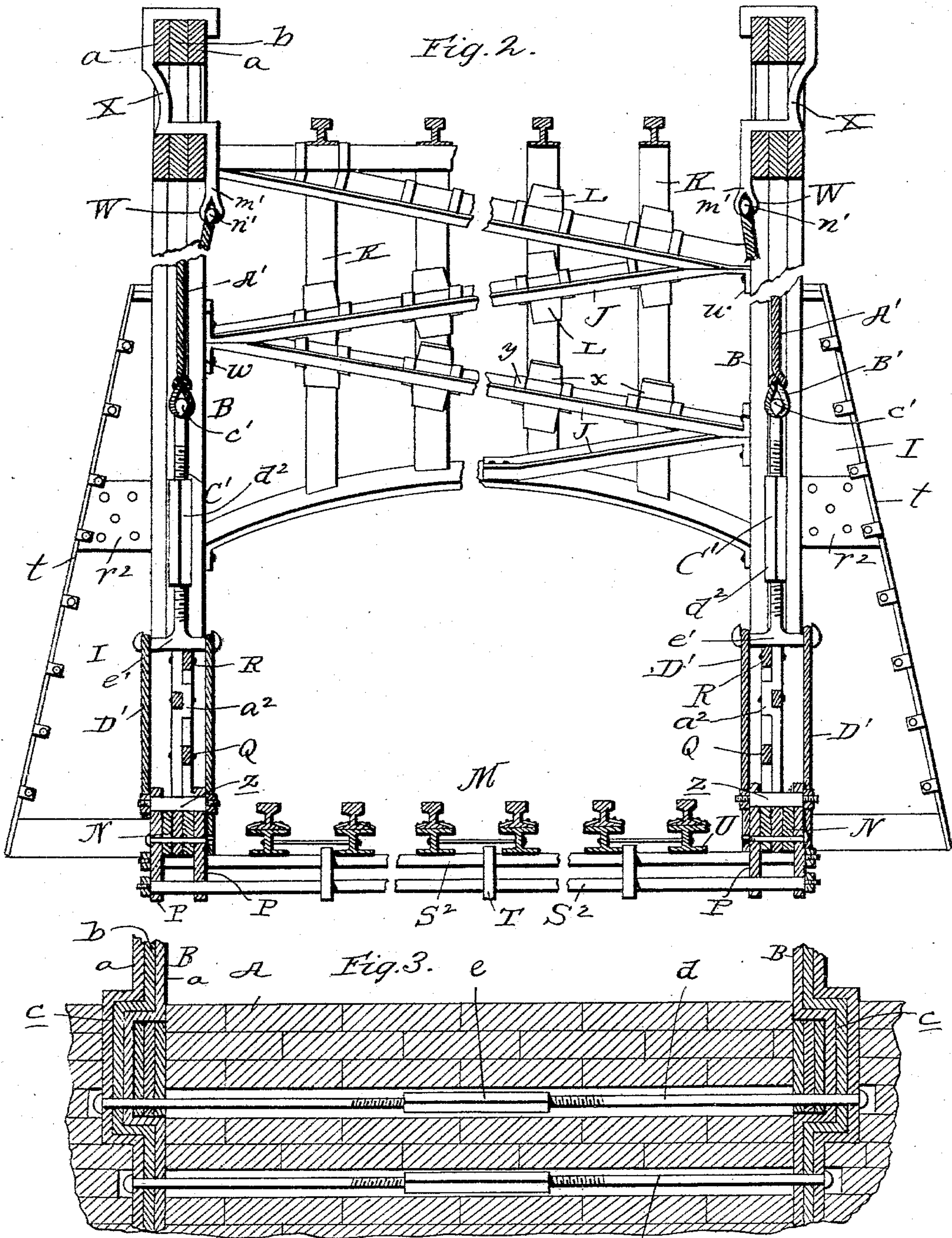
(No Model.)

5 Sheets—Sheet 2.

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5 Sheets—Sheet 3.

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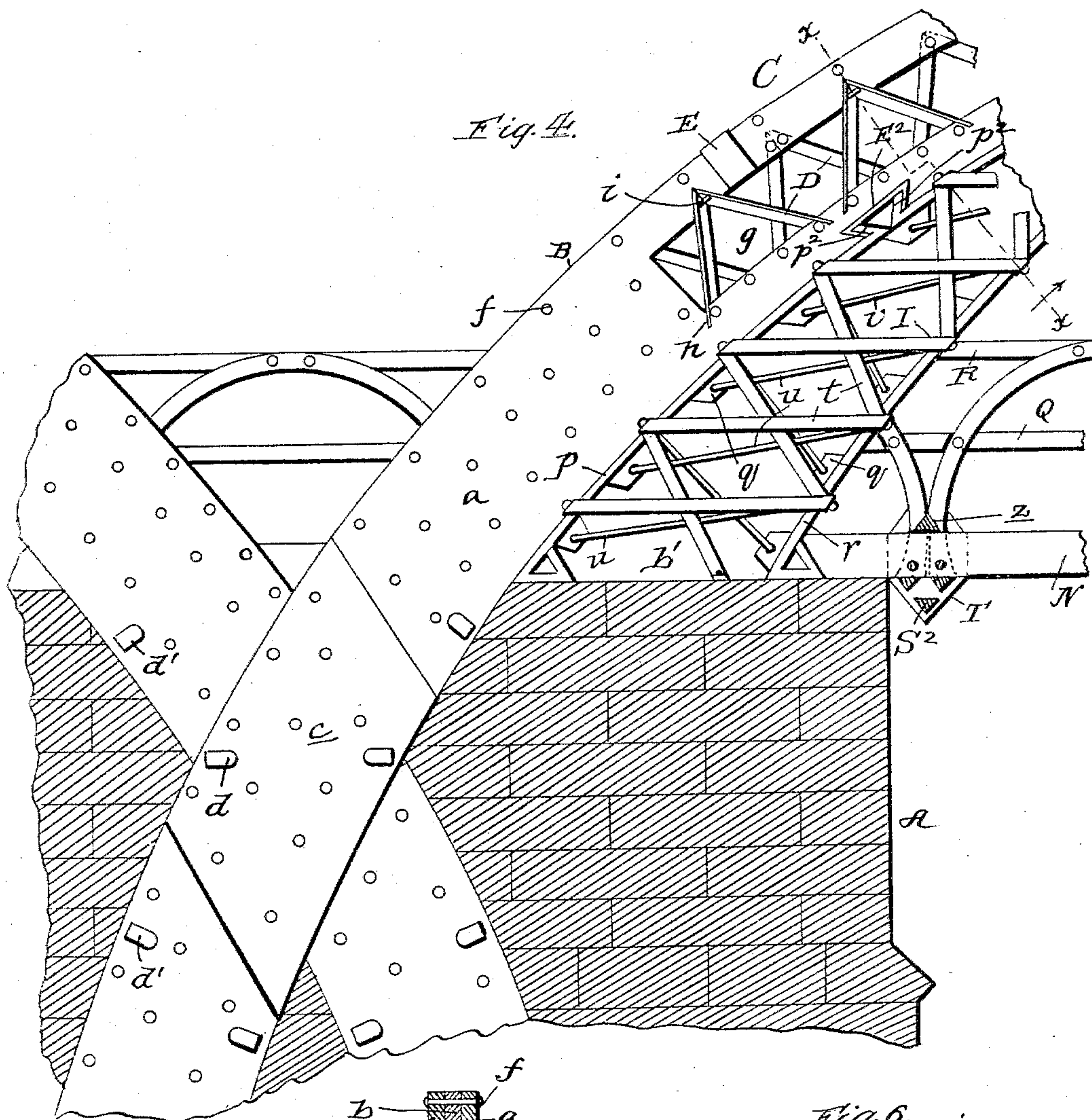


Fig. 7. j.

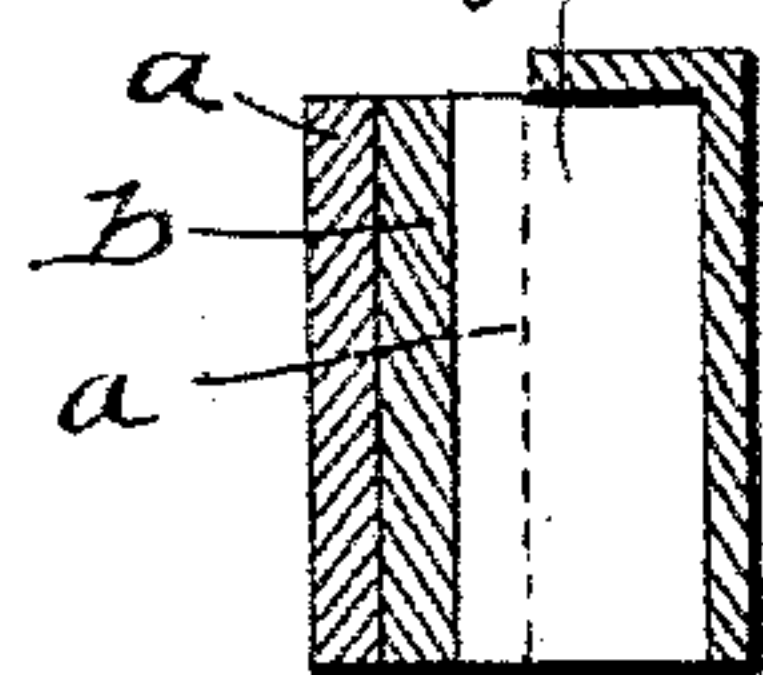


Fig. 5.

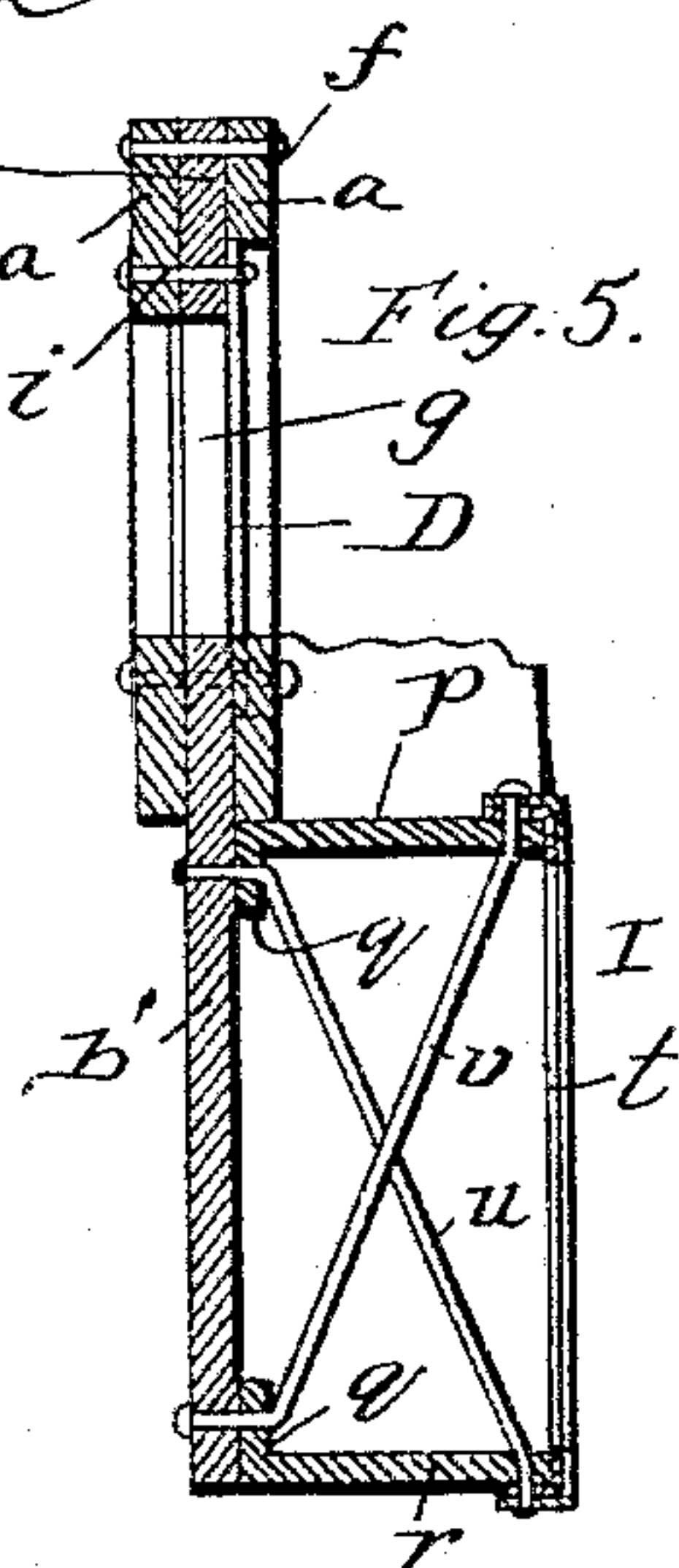
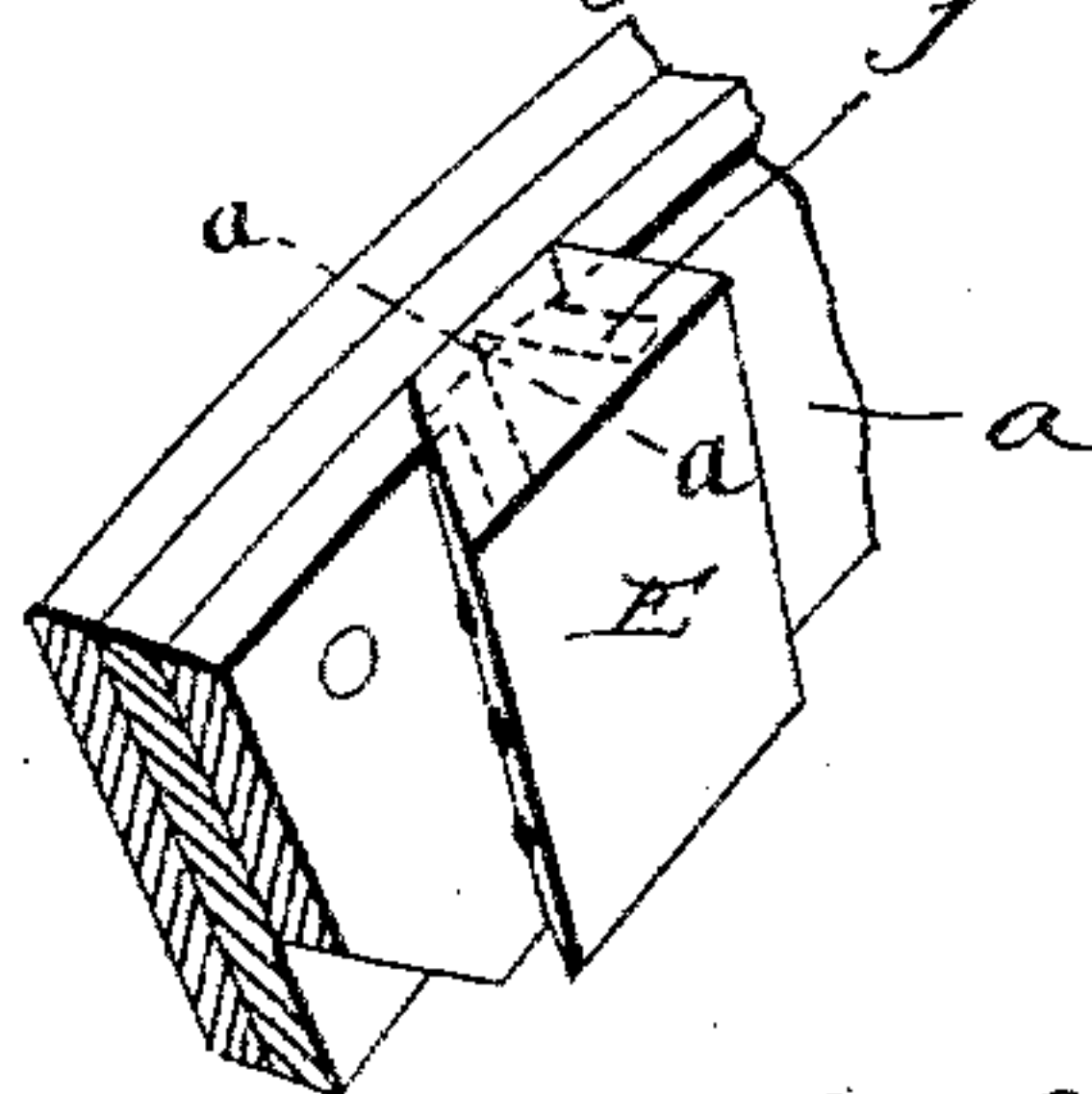


Fig. 6.



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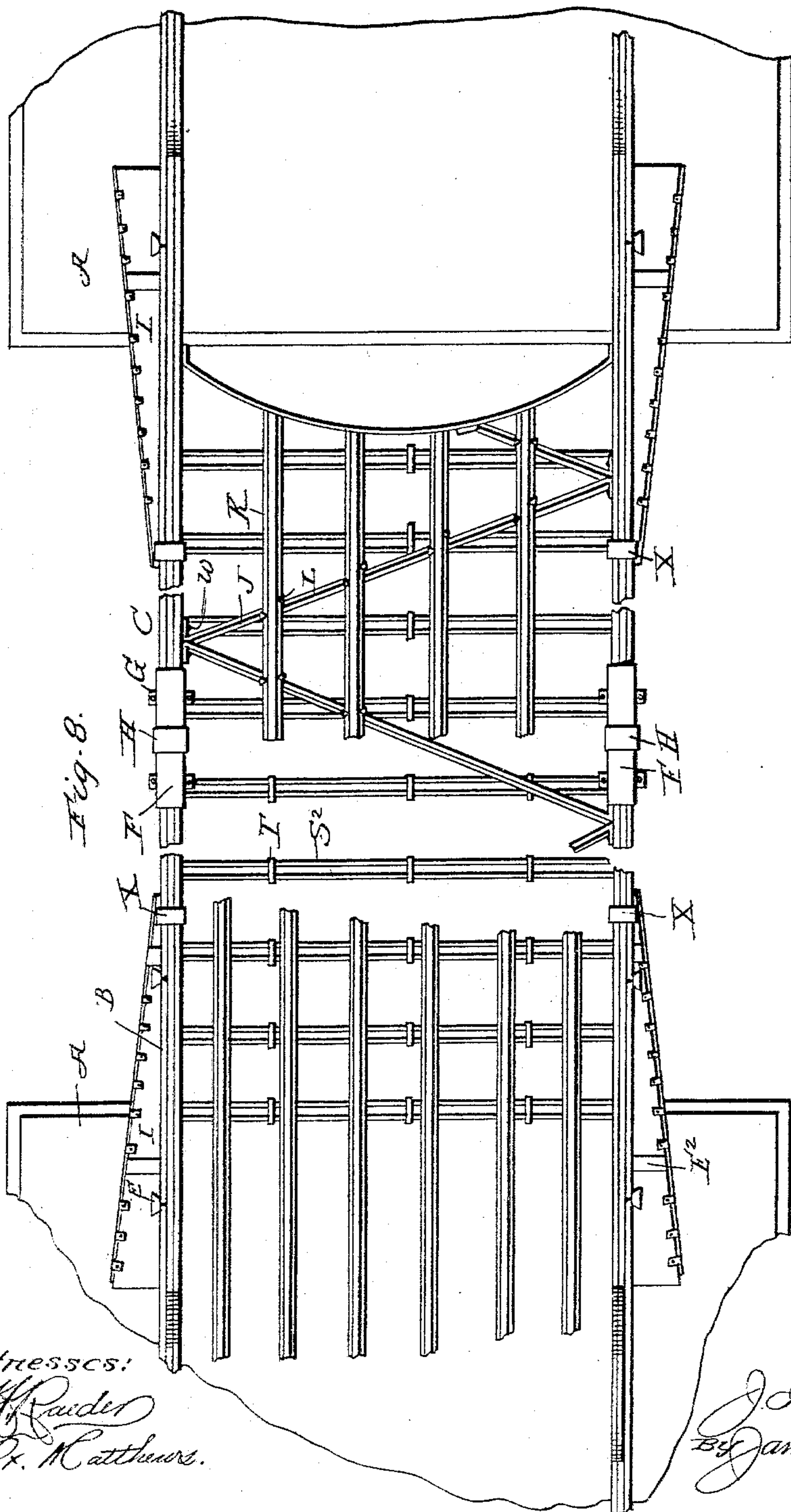
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5 Sheets—Sheet 4.

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No. 565,020.

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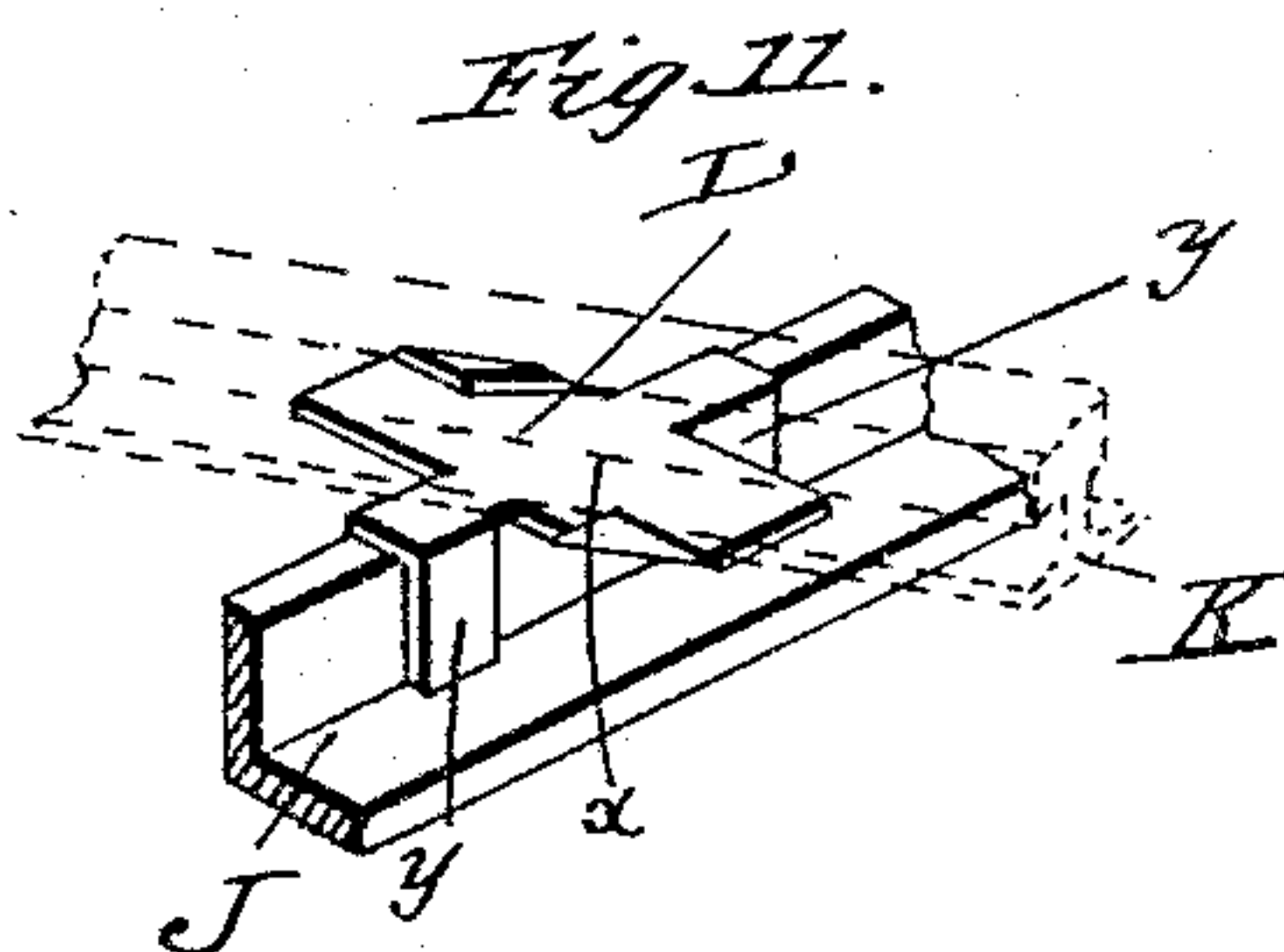
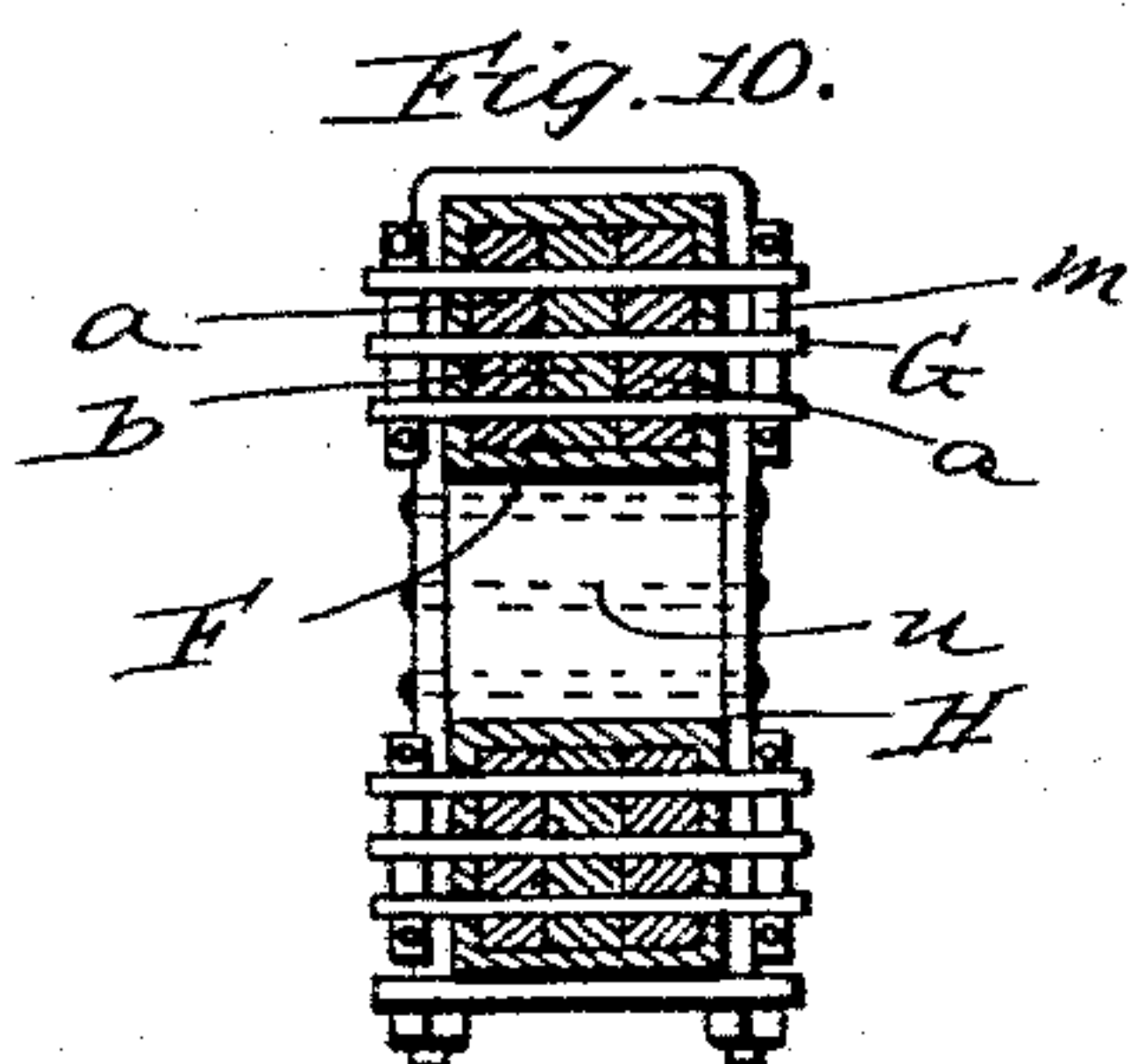
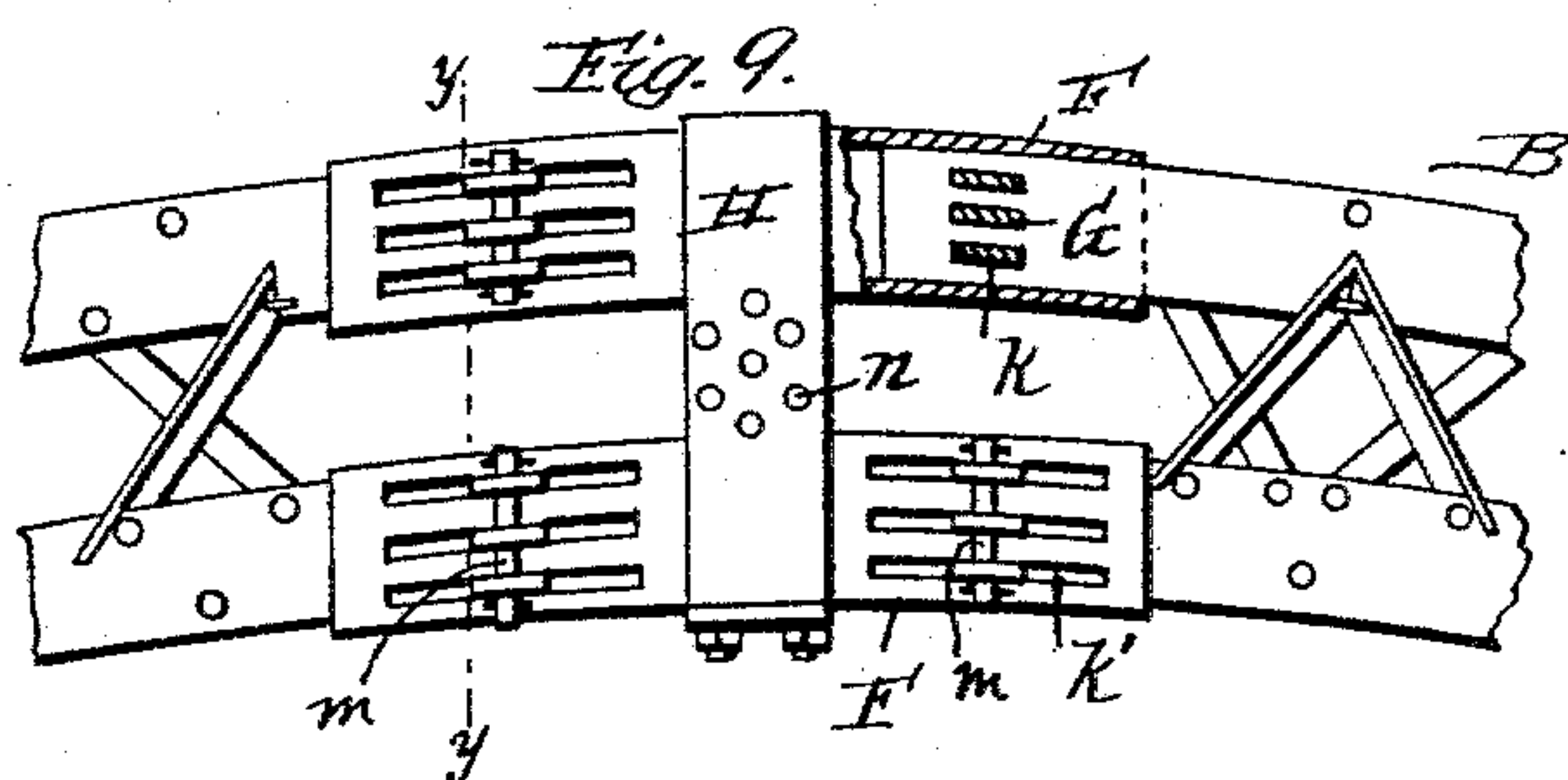
(No Model.)

5 Sheets—Sheet 5.

J. I. NEWBURG.
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UNITED STATES PATENT OFFICE.

JOHN ISRAEL NEWBURG, OF VICKSBURG, MISSISSIPPI.

BRIDGE.

SPECIFICATION forming part of Letters Patent No. 565,020, dated August 4, 1896.

Application filed October 28, 1895. Serial No. 567,158. (No model.)

To all whom it may concern:

Be it known that I, JOHN ISRAEL NEWBURG, a citizen of the United States, residing at Vicksburg, in the county of Warren and State of Mississippi, have invented certain new and useful Improvements in Bridges; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in bridges; and it has for one of its objects to provide a bridge in which the contiguous end portions of the arches of the several spans are tied together or interlocked in the piers or abutments, so as to materially strengthen the connection of the arches together and to the piers or abutments and enable the said arches to resist or withstand great weight and strain and render the bridge free from vibration.

Another object of the invention is to provide a bridge in which the arches are formed in two sections and strongly joined at the middle of a span or at any other suitable point in such a manner as to permit of the expansion and contraction incident to heat and cold.

Another object of the invention is to provide a bridge in which the arches of the several spans are supported and braced to enable them to further resist weight and strain and withstand the power of high winds; and still another object of the invention is to so brace and connect the girders of the arches that the braces or connections may be utilized to support track-rails and form a tramway over the arch of the bridge to assist in the building of the same.

Other objects and advantages of the invention will appear from the following description and claims, when taken in connection with the accompanying drawings, in which—

Figure 1 is a broken side elevation of a bridge embodying my invention. Fig. 2 is an enlarged transverse section taken in the plane indicated by the line $z z$ of Fig. 1, looking in the direction of the arrow. Fig. 3 is a detail section taken through one of the piers or abutments to illustrate the manner in which the plates at the contiguous ends of the girders of two arches are lapped or inter-

locked and tied together in the piers and the manner in which said girders are secured in the piers or abutments. Fig. 4 is an enlarged side elevation designed to illustrate the same construction as Fig. 3. Fig. 5 is a section taken in the plane indicated by the line $x x$ of Fig. 4, looking in the direction indicated by arrow. Fig. 6 is a detail perspective view illustrating the manner in which certain pieces comprised in the girders of the arches are connected together. Fig. 7 is a detail section taken in the plane indicated by the line $a a$ of Fig. 6. Fig. 8 is a plan view with parts broken away. Fig. 9 is a detail side elevation, partly in section, illustrating the manner in which the sections of the arch-girders are connected at the middle of a span to permit of expansion and contraction. Fig. 10 is a transverse section taken in the plane indicated by the line $y y$ of Fig. 9, and Fig. 11 is a detail perspective view of the peculiar and advantageous device for connecting the rails to the braces or bars connecting the girders of the arches.

In the said drawings similar letters designate corresponding parts in all of the views, referring to which, A indicates the piers or abutments of my improved bridge, which may be placed at any desired distance apart and may in general be constructed in the ordinary manner, of masonry or other suitable material, and B indicates the girders of the arches C. These girders B respectively comprise three vertically-disposed plates $a a b$, and at or adjacent to one end of each arch these plates $a a b$ are provided with the offset portions c (see Figs. 3 and 4) to receive the straight plates at the contiguous ends of the girders of the next arch, so as to enable the girders of the two arches to cross each other and yet rest in the same vertical plane, and in such a position, as will be seen, that weight and strain imposed on one arch will be borne in part by the arches on opposite sides of the same. The end portions of the girders of adjacent arches are crossed in the piers or abutments A while the latter are being built, and the girders of the arches, as well as the plates of each girder, are connected by the transverse tie-rods d , which take through the plates and girders where they cross each other and are provided at their middles with turnbuckles e , whereby

they may be drawn taut to rigidly and securely hold the girders of the two adjacent arches in engagement with each other. The girders of the arches and the plates comprised in said girders are also connected together, above and below the points where the girders cross, by the transverse tie-rods d' , which are similar to and are designed for the same purpose as the tie-rods d . After the tie-rods d d' are properly placed and secured in position, the building of the piers or abutments A is continued until they extend above the uppermost rods d' a suitable distance, when it will be seen that the tie-rods will not only serve to connect the girders but will materially strengthen the connection of the girders to the piers or abutments.

The girders B are provided, as better shown in Figs. 1, 2, 4, and 5, with the transversely-disposed openings g , which extend from points slightly above the piers A to the middle of the arches, as illustrated, and are designed to render the girders lighter and in addition to afford space for the braces D, (better illustrated in Fig. 4 of the drawings,) which serve to materially strengthen the girders. These braces D are of a right-angle form in cross-section and are arranged obliquely, as shown, and so that the braces on one side of the girders will cross the braces on the opposite side of the same. At their lower ends said braces have their transversely-disposed portions seated in notches or seats h , formed in the lower portions of the outer plates a , their longitudinally-disposed portions resting on the inner sides of plates a and receiving rivets, and at their upper ends the said braces are mitered and arranged on the outside of the plates a , and connected together and to the plates a by staples i , as shown. The said braces D weigh very much less than the metal displaced to form the openings g , and they serve to render the girders equally as strong if not stronger than they would be were the metal not removed and the openings g not formed.

In order to permit of them being easily produced and conveniently handled in the building of the bridge, the middle plates b , as well as the outside plates a , of the girders are formed in a number of pieces arranged end to end. The pieces of the middle plate b are connected together and secured in position by the connecting rivets or bolts f , which take through the three plates, while the pieces forming the outside plates a are connected together in the manner better shown in Figs. 4, 6, and 7 of the drawings, care being taken to break joints, that is to say, to place the connections of the portions of the pieces above the opening g at a distance from the connections of the pieces below the openings g , and also at a distance from the connections of the plate-pieces on the other side of the girder. In connecting the pieces of the plates a , the contiguous ends of the pieces to be joined are turned outwardly, as indicated by j , until they form, with the body portions of the plate-

pieces, acute angles, as illustrated in Fig. 6. A clip or coupling E, of dovetail form in cross-section and having its upper end closed, is then slipped upon the end portions j , and its side walls are riveted to said portions j , so as to securely and strongly connect said portions and consequently the plate-pieces together.

As before mentioned, the girders B of each arch are made in two sections which are joined, preferably at the middle of the span, by a link in such manner as to permit of expansion and contraction incident to changes in the temperature. In forming this link-joint (see Figs. 9 and 10) the upper and lower portions of the girder-sections are provided adjacent to their meeting ends with three (more or less) transversely-disposed slots k , and the sleeves F, which form the link and receive said meeting ends of the girder-sections, are provided in their side walls with elongated slots k' , which aline with the slots k , and are designed in connection with the same to receive the transverse bars G, which are secured in position by vertical keys m , taking through their ends, as better shown in Fig. 10. The upper and lower sleeves F are connected together by the clip H, which receives them; and the connection is braced and strengthened by the transverse bolts n of the clip, which are interposed between the two sleeves F, as shown. By virtue of this construction just described the ends of the girder-sections are connected in a strong and durable manner, and yet the said girder-sections have a limited movement independent of each other and are consequently free to expand and contract with the changes in temperature, which is an important desideratum.

As better shown in Figs. 4 and 5 of the drawings, the inner plates b of the girders B are abruptly increased in width at the top of the piers or abutments, so as to form an extended portion b' , which rests on the inner, under side of the girders and bears at its lower end upon the top of the piers or abutments, so as to materially strengthen the girders and enable them to sustain a great weight. These extensions b' of the plates b are gradually reduced in width to their upper ends and are of about the proportional length shown, and in addition to supporting and strengthening the girders they serve for the connection of the supports I. (Better shown in Figs. 4 and 5.) These supports I bear at their lower ends on the top of the piers or abutments A, and are gradually reduced in width toward their upper ends, as shown, and they are respectively formed by the upper curved plate p , which is disposed laterally to the arch-girder and has the lug-flanges q at its inner ends and is gradually reduced in width to its upper end; the lower curved plate r , which is also disposed laterally to the girder and also has lug-flanges q at its inner edge, and is also gradually reduced in width to its upper end; the flat brace-bars t , which cross each other and extend from the outer edge of

the plate p to the outer edge of the plate r , and have their ends bent over said plates; the tie-bars u , which extend through the lower bent ends of the braces t , the lower plate r , the flange-lugs q of the upper plate p , and the girder extension b' and serve to connect said parts together and to the said extension of the girder-plate b , and the tie-bars v , which extend through the bent upper ends of braces t , the upper plate p , the flange-lugs q of the lower plate r , and the extension b' of the girder, and also serve to connect said parts together and to the girder extension. These supports I , as will be readily observed, materially assist the girders in sustaining weight and strain, and they also serve to securely brace the girders, so as to enable them to better withstand the lateral pressure of high winds, which is an important desideratum.

The plates r of the supports I may be formed in pieces connected by plates r^2 , (see Fig. 1,) and the plates p of said supports may also be formed in two or more pieces, which may be connected, as shown in Fig. 4, by providing the pieces with flanges p^2 at their contiguous ends and placing a dovetail coupling E^2 over said flanges and suitably connecting it thereto.

J (see Figs. 2 and 8) indicates oblique connecting bars or braces of right-angle form in cross-section, which are interposed between the girders B and are provided at their ends with flanges w for the passage of bolts which connect them to the girders B ; and K indicates rails which are placed on the bars or braces J , so as to form a tramway upon which cars may be placed while the bridge is being built for the convenient hauling of materials and workmen, and also to enable the builder to dispense with a great deal of false work and scaffolding usually employed in bridge-building. These rails K are left in position after the bridge is completed, as they serve to materially strengthen the bridge, and they are connected to the braces or bars J by the combined clips and fish-plates L . (Better illustrated in Fig. 11 of the drawings.) These clips and fish-plates L are preferably formed in one piece and they respectively comprise a fish-plate x , adapted to receive and hold a rail, and the clips y on opposite sides of the fish-plate, which are designed and adapted to straddle one of the branches of the angular bars J and secure the fish-plates and consequently the rails on said bars J . In this way it will be observed that the rails K are secured in position without the employment of spikes, bolts, or the like, which admits of them being quickly and easily laid and as quickly disconnected and removed when desired.

M indicates the roadway of my improved bridge, which is preferably not attached to the abutments or piers A and is free to slide thereon as its length is increased or diminished by changes in temperature. This roadway M comprises the longitudinal side bars N , which extend the full length of the bridge, the plates P , resting on opposite sides of the

side bars N at intervals in the length thereof, the lower and upper side rails Q R , the arch bars or braces S , which rest adjacent to their lower ends on and engage the triangular bolt z , connecting the plates P above the bars N , and have offsets a^2 , (see Fig. 2,) so as to enable them to cross each other and the rail Q and yet rest in the same plane as said rail Q , to which and the upper rail R they are connected by bolts or rivets, as shown, and also have their lower ends arranged between and connected by bolts to bars n , the transverse bars S^2 , of angular form in cross-section, extending through and connecting the plates P on opposite sides of the bars N and beneath the said bars N , and having their ends reduced and threaded to receive securing-nuts, the plates T , mounted on and connecting the said bars S^2 at intervals in the length thereof, the I-beams U , mounted on and secured to the bars S^2 , and the rails mounted on and secured to the I-beams. Of course when the bridge is to be used simply as a carriage-way the railway-rails may be dispensed with and the I-beams may also be dispensed with and a suitable floor laid and suitably secured upon the bars S^2 .

A bridge-roadway such as just described, while easy to construct, is very strong and durable without being heavy. It will be observed that the bars S^2 , being arranged in the plates P with their apexes downward, have a broad and strong bearing and that they afford a substantial and yet a resilient roadway for the track-rails, which is a desideratum. It will also be observed that the arch-braces S are securely fastened at their ends to the bolts z , and at intermediate points of their length to each other and to the rails Q and R , and that therefore they will serve as an arch and as a cantaliver to brace and strengthen the roadway.

The roadway M is suspended from the girders B of arch C through the medium of the devices W , (better illustrated in Fig. 2,) which are of various lengths to suit the distances between the roadway and the arch at various points in the length thereof. These devices W , while of various lengths, are similar in construction, and therefore a description of one or two will suffice for all. As shown in Fig. 2, the said devices W are provided at their upper ends with the hooks X , which are shaped so as to bear upon the upper side of the upper portion of the girders B and the upper side of the lower portion of said girders, so as to effect a strong and durable connection of the suspending devices to said girders. At their lower ends the hooks X are provided with two parallel branches m' , through which take bolts n' , and to these bolts are connected cables A' , which are suitably connected at their lower ends to the endless cables B' , as shown. These endless cables B' at their ends are looped over the preferably hooked ends of a T-head c' , at one end of a connection C' , which has a turnbuckle d^2 , as

shown, whereby it may be readily increased or diminished in length. At its lower end the connection C' is provided with a T-head e', having preferably hooked ends, as shown, and over these hooked ends are arranged the endless cables D'. These endless cables pass downwardly upon opposite sides of the bars N and plates P, and at their lower ends they are looped over lateral hooks f', carried by castings E', which are arranged beneath the bars N at proper intervals in the length thereof, as better shown in Fig. 1 of the drawings. In this manner it will be seen that between the piers or abutments A the roadway of the bridge is suspended from the arches C, and that weight and strain imposed on said roadway is transferred to the arches, which, as will be appreciated from the foregoing, are well able to withstand or resist it. It will also be observed that my improved suspending devices form a strong and durable connection between the arches and the roadway, that they may be readily tightened and kept taut, and that the parts are so connected that when one part is worn or otherwise impaired it may be readily removed and replaced by a new part without damage to the other parts.

I have provided a very strong and durable bridge and one which may be easily constructed and which will add to rather than detract from the beauty of a landscape, and I have specifically described the construction and relative arrangement of the parts thereof in order to impart a full, clear, and exact understanding of the same. I do not desire, however, to be understood as confining myself to such construction and arrangement of parts, as such changes or modifications may be made in practice as fairly fall within the scope of my invention.

Having described my invention, what I claim is—

1. A bridge comprising a pier or abutment, an arch having its girders arranged at one end in the pier or abutment and a second arch having its girders arranged at one end in the pier or abutment and lapping and connected with the girders of the first-named arch within the pier or abutment, substantially as specified.

2. A bridge comprising a pier or abutment, an arch having its girders arranged at one end in the pier or abutment and provided with a lateral offset c, a second arch having its girders arranged at one end in the pier or abutment and crossing the girders of the first-named arch, and resting in the offsets thereof and a suitable means for connecting the girders of the two arches, substantially as and for the purpose set forth.

3. A bridge comprising a pier or abutment, an arch having its girders arranged at one end in the pier or abutment and provided with a lateral offset c, a second arch having its girders arranged at one end in the pier or abutment and crossing the girders of the first-

named arch and resting in the offsets of said girders, and rods connecting the girders of the two arches at their crossing-point and above and below said crossing-point, substantially as and for the purpose set forth.

4. A bridge comprising a pier or abutment, an arch having girders formed by a plurality of plates arranged side by side and also having said girders arranged at one end in the pier or abutment, and a second arch having girders formed by a plurality of plates arranged side by side and having said girders arranged at one end in the pier or abutment and connected within the pier or abutment with the girders of the first-named arch, substantially as and for the purpose set forth.

5. A bridge comprising piers or abutments, and an arch, the girders of which are arranged at the ends of the arch in the piers or abutments and have extensions or extended portions on their inner under sides bearing upon the tops of the piers or abutments, substantially as and for the purpose set forth.

6. A bridge comprising piers or abutments, an arch having its girders arranged at its ends in the piers or abutments and provided on their inner, under sides with extensions or extended portions bearing upon the tops of the piers or abutments, and supports arranged at the sides of the girders and bearing upon the piers or abutments and connected to the extensions or extended portions of the girders, substantially as and for the purpose set forth.

7. A bridge comprising a pier or abutment, and arches having their girders arranged at one end in the pier or abutment and connected together within said pier or abutment and provided on their inner, under sides with extensions or extended portions bearing upon the piers or abutments, substantially as and for the purpose set forth.

8. A bridge comprising a pier or abutment, arches having their girders arranged at one end in the pier or abutment and connected together within said pier or abutment and provided on their inner under sides with extensions or extended portions bearing upon the piers or abutments, and supports arranged at the sides of the girders and bearing upon the piers or abutments and connected to the extensions or extended portions of the girders, substantially as and for the purpose set forth.

9. A bridge having piers or abutments and an arch, the girders of which are arranged at the ends of the arch in the piers or abutments and comprise intermediate and outer plates arranged side by side and connected together; the intermediate plate of each girder being provided with an extended portion or extension on the under side of the girder and adapted to bear at its lower end upon a pier or abutment, substantially as and for the purpose set forth.

10. A bridge having piers or abutments and an arch; the girders of which are arranged

at the ends of the arch in the piers or abutments and comprise intermediate and outer plates arranged side by side and connected together; the intermediate plate of each girder
5 being provided with an extended portion or extension on the under side of the girder adapted to bear at its lower end upon a pier or abutment, and the supports bearing at their lower ends on the piers or abutments
10 and connected to the extensions of the intermediate plates of the girders, substantially as and for the purpose set forth.

11. A bridge comprising a series of piers or abutments, and arches having their girders arranged at their ends in the piers or abutments and in such a manner that the girders of one arch lap or cross and are interlocked with the girders of the arch or arches next to it, substantially as and for the purpose set
20 forth.

12. A bridge-arch comprising two sections provided with girders having elongated, transverse slots adjacent to their meeting ends, sleeves receiving the ends of the girders and having elongated, transverse slots, and bars taking through the elongated slots of the girders and sleeves and secured in such position, substantially as and for the purpose specified.
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13. In a bridge, the arch-girders having the openings *g*, the seats or notches *h*, in the lower walls of said openings, and the braces of angular form in cross-section seated in the seats or notches *h*, and extending across the openings *g*, on opposite sides of the girders and having their lower ends secured by rivets or bolts and their upper ends mitered and connected together and to the girders by staples, substantially as and for the purpose set forth.
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14. In a bridge, an arch comprising girders, brace-bars resting between and connecting the girders and railway-rails mounted and secured upon said brace-bars and extending in the direction of the length of the arch, substantially as and for the purpose set forth.
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15. In a bridge, an arch comprising girders, brace-bars resting between and connecting the girders, railway-rails mounted upon said brace-bars and extending in the direction of the length of the arch, and the connecting devices having fish-plates adapted to receive and hold the rails and means for engaging the brace-bars and connecting the fish-plates thereto, substantially as and for the purpose set forth.
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16. A bridge comprising an arch having girders provided with openings *g*, a roadway,

and a device for suspending the roadway from the girders of the arch and having a hook at its upper end provided with a portion for engaging the portion of the girders above the opening *g*, and a portion for engaging the lower portion of the girders, substantially as and for the purpose set forth.
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17. A bridge having piers or abutments, an arch, a roadway comprising the longitudinal bars *N*, the plates *P*, arranged on opposite sides of the bars and connected together above said bars, the bars *S*², of triangular form in cross-section having their ends secured in the plates *P*, on opposite sides of the roadway and arranged with the apexes of their angles down, and a suitable means for suspending said roadway from the arch, substantially as and for the purpose set forth.
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18. A bridge having piers or abutments, an arch, a roadway resting upon the piers or abutments and comprising the longitudinal bars *N*, the plates *P*, arranged on opposite sides of the bars *N*, and connected above said bars, the cross-bars having their ends secured in the plates *P*, and adapted to support railway-rails or a flooring, the lower and upper side rails *Q*, *R*, and the arches *S*, having their ends secured between the plates *P*, and connected at intermediate points of their length to the rails *Q*, *R*, and crossing each other, and a suitable means for suspending the said roadway from the arch, substantially as specified.
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19. A bridge comprising piers or abutments, an arch, having girders, a roadway resting upon the piers or abutments and comprising the longitudinal bars, castings *E'*, arranged beneath said bars of the roadway and having lateral hooks, and the suspending devices comprising hooks engaging the girders of the arch, the connections *C'*, having T-heads at their opposite ends and also having a turnbuckle, cables connected to the girder-engaging hooks, endless cables connected to the lower ends of the said cables and engaging the T-heads at the upper ends of the connections *C'*, and endless cables connecting the lower T-heads of the connections *C'*, and the lateral hooks of the castings *E'*, and resting on opposite sides of the bars *N*, substantially as and for the purpose set forth.
95 100 105

In testimony whereof I affix my signature in presence of two witnesses.
110

JOHN ISRAEL NEWBURG.

Witnesses:

D. J. KLENKY,
GUSTAV SINA.